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ORIGINAL ARTICLES.

I.—On the Permian-Trias Question.

By Jules Marcou, For. Memb. Geol. Soc. Lond.

THE Rev. A. Irving, in the January Number of the Geological Magazine, p. 46, writes: "The argument then in favour of the retention of the name 'Permian' (as against *e.g.* that of 'Dyas') is based on no logical consistency with established geological nomenclature. It is an excellent local name for the Russian series, but as a general term for the European series it is highly misleading."

A few quotations from memoirs and geological maps on Russia will show that the term 'Permian' is even more objectionable and misleading for the Russian series than for any other parts of Europe.

Murchison defined his proposed system, and affirmed the non-existence of the Triassic series, in his great work *Russia and the Ural Mountains*, vol. i. 1845, in the following manner:—"Our Permian System embraces everything which was deposited between the conclusion of the Carboniferous epoch and the commencement of the Triassic series," pp. 140, 141, excluding "the Rothe-todte-liegende of Germany from our Russian natural group." Farther at p. 182, we read: "We have not indeed any sort of evidence to prove that the masses we are describing constitute a portion of the Trias of Europe . . . . . simply considering it a great and copious cover of the Permian system." . . . . . "On the whole, however, we confess we are disposed to view these variegated sands and marls like those of Orenburg as a part of the Permian system." Finally, p. 193; "Mount Bogdo.—Having already stated that we have no proof of the existence of rocks of the age of the Trias in the central region of Russia . . . . . ."

As Murchison placed then the Rothe-todte-liegende in the Carboniferous, and did not recognize the Trias (except at Mount Bogdo), or the Lias, or the Lower Oolite in Russia, his 'Permian System,' as defined by him, comprehended in one lump all the Russian rocks existing between the Rothe-todte-liegende and the Oxfordian or Middle Oolite rocks, which, according to Murchison, "occupy a region more than twice the size of the whole Kingdom of France" (*Russia*, p. 137).

If we look at Murchison's *Geological Map of Russia*, we see the 'Permian' marked No. 4 occupying almost half of the Russian Empire in Europe. The Trias marked No. 5 is reduced to a small

spot, of the size of a pea, north-east of Astrakan at the Grand Bogdo Mountain.

On his *Geological Map of Europe*, in collaboration with James Nicoll, 1856, in four sheets, Murchison colours and marks with the letter *e* as 'Permian' all the rocks in Russia between the Carboniferous and the Jurassic, excluding even the Trias of Mount Bogdo, with the remark however, inscribed under the word Grand Bogdo: "Limestone with Trias fossils on Saliferous Sandstone."

The two general Geological Maps of Russia published at St. Petersburg by Colonel Ozerski in 1849, and by General Helmersen in 1863, reproduce the geographical distribution of the 'Permian' as it was delineated by Murchison, with a few alterations near the foot of the north-eastern part of the Ural Mountains.

The first general Geological Map of Russia, after Helmersen's of 1863, is Valérien de Moeller's *Carte des gites miniers de la Russie d'Europe*, 1878. Here we have a map differing entirely, as to the distribution of the Trias and 'Permian,' from those previously quoted. Instead of the single small spot of Trias of Mount Bogdo, we have an immense surface, twice as large as England and Scotland together, coloured as Trias, while the 'Permian' is so much diminished in size, as to occupy only a very modest place, along the western foot of the Ural Mountains and at a few spots along the Volga river, also east and north of Moscow, and near Mittau in Courland. In fact, the 'Permian System' in the map of Moeller, 1878, plays a very secondary part in the geology of Russia.

In a special Geological Map of the Ural Mountains, entitled *Carte géologique du versant occidental de l'Oural*, published in 1869, M. Valérien de Moeller gave already an entirely different view of the geographical distribution and stratigraphical section of the so-called 'Permian Series.' For not only M. de Moeller admits fully the existence of the Trias, over immense surfaces precedently coloured as 'Permian,' but he divides the rocks placed between the Trias and the Carboniferous into two great groups, one formed of Limestone with marls, slates, gypsum and salt, and the other of Sandstone, conglomerate, copper grits and coal; in fact, M. de Moeller's 'Permian' is a regular Dyas, somewhat similar to the Dyas of Central Germany.

How such a great change came about requires a few words of explanation; for it seemed according to Murchison that we have in Russia a type of a formation badly defined in Germany and in England, and that for the first time himself and his associates De Verneuil and von Keyserling had found in the great Russian Empire, and more especially in the Government of Perm, proof of the existence of a great series of rocks, which he offered to geologists as a typical formation, under the title of the 'Permian System.'

The publication of my memoir, entitled *Dyas et Trias*, at Geneva, in 1859, first attracted attention to the difficulties and even impossibilities of accepting such a type, so far from Central Germany and the classical ground of Thuringia in Saxony; and with such an unsatisfactory description as the one contained in *Russia and the Ural Mountains.*

Shortly after Rudolph Ludwig made a journey to the Ural Mountains, and explored especially the series of rocks considered by Murchison as his typical formation of the 'Permian' in the Government of Perm. He soon recognized the errors of superpositions, classifications and determinations of ages committed by his predecessors, and having convinced himself there on the field that Murchison by mistake has placed in his 'Permian System' the whole of the Trias, he published successively his *Geogenische und geognostische Studien auf einer Reise durch Russland und den Ural*, with a Geological Map of a part of the Government of Perm;[1] and his Geological Map, *Die Dyas in Russland*, in the beautiful and excellent monograph of the *Dyas*, by H. B. Geinitz, 1861 and 1862.

Other discoveries followed; and now even in Russia the word 'Dyas' is used, as more appropriate than any other offered until now, to designate a series of rocks, so well known and distinguished in Germany under the double appellation of Rothe-todte-liegende or Rothliegende and Zechstein.

The celebrated Russian geologist, the late Edouard d'Eichwald, has signalized and pointed out the Government of Orenburg as better fitted to give a fine series of the Dyassic rocks than the Government of Perm, long before Mr. W. H. Twelvetrees; for we read in his introduction to vol. i. part 2, of his *Lethea Rossica*, p. 17, 18, Stuttgart, 1860: "The Permian System is the same as the Pénéen, which is better worth preserving as a geological name, than Permian, especially as the animals and plants characteristic of the Pénéen System are not found in the Government of Perm, but in that of Orenburg." "In the *Lethea*, I have sometimes called these strata Cupriferous sandstones, sometimes Magnesian or Zechstein, limestone which is interpolated between the beds of Cupriferous sandstone: thus well deserving the name of 'Dyas' suggested by M. J. Marcou."

Finally, Prof. C. Greveingk uses the word Dyas in his description and on his large *Geognostische Karte der Ostseeprovince Liv.-Est.- und Kurland*, Dorpat, 1879.

CAMBRIDGE, MASSACHUSETTS, U.S.A.

II.—On the Diplodocidæ, a New Family of the Sauropoda; an Order of American Jurassic Dinosaurs.[2]

By Professor O. C. Marsh, M.A., F.G.S.

THE *Sauropoda* are now generally recognized by anatomists as a well-marked order of the Sub-class *Dinosauria*. In the previous articles of this series, the main characters of the two families of this order (*Atlantosauridæ* and *Morosauridæ*) already named by the writer have been given.[3] A third family is represented by the genus

[1] The city of Perm, which has given its name to the Government of Perm and to the 'Permian System,' is not built on the so-called 'Permian,' but on the Trias.

[2] From the American Journal of Science, vol. xxvii. February, 1884, pp. 161–168.

[3] See Silliman's American Journal of Science, vol. xvi. p. 411, Nov., 1878; vol. xvii. p. 86, Jan., 1879; vol. xxi. p. 417, May, 1881; vol. xxiii. p. 81, Jan., 1882; and vol. xxvi. p. 81, Aug., 1883.